

Patent Claims

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Substrate for Supporting an Object and Method for Producing Said Substrate

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1. A substrate (10) designed to support an object (12) to be processed, such as a substrate for a semiconductor element, the substrate containing carbon and being designed to be porous so as to form gas outlet or passage openings,

characterized in

that the substrate (10) is comprised of a framework or a segment of a framework made of carbon fibers and/or SiC fibers (18, 20), that the fibers are embedded in a matrix made of carbon and/or SiC, and that the substrate has a porosity level p of $5\% \leq p \leq 95\%$ and a density ρ of $0.1 \text{ g/cm}^3 \leq \rho \leq 3.0 \text{ g/cm}^3$.

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2. A substrate according to Claim 1,

characterized in

that the framework is comprised of carbon felt, non-woven material and/or fabric layers.

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3. A substrate according to Claim 1,

characterized in

that the fibers (18, 20) are provided with one or more carbon or pyrocarbon and/or silicon carbide layers (26, 28) as the matrix.

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4. A substrate according to at least one of the preceding claims,

characterized in

that the matrix is provided on its outer surface with a silicon carbide coating.

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5. A substrate according to at least one of the preceding claims,

characterized in

that the matrix comprises a coating system that transitions in a graduated fashion from carbon to silicon carbide.

6. A substrate according to at least one of the preceding claims,

characterized in

that the thermal conductivity w of the substrate (10) ranges from $0.10 \text{ W/mK} \leq w \leq 100 \text{ W/mK}$, especially $3 \text{ W/mK} \leq w \leq 30 \text{ W/mK}$.

7. A substrate according to at least one of the preceding claims,

characterized in

that the substrate has a total density of 1.50 g/cm^3 to 1.9 g/cm^3 , the proportion of fibers being 0.098 g/cm^3 to 0.2 g/cm^3 and/or the proportion of pyrocarbon being 0.4 g/cm^3 to 0.8 g/cm^3 and/or the proportion of SiC being 0.8 g/cm^3 to 1.0 g/cm^3 .

8. A substrate according to at least one of the preceding claims,

characterized in

that the weight ratio of framework to matrix totals approximately 1 : 13 to 1 : 17.

9. A method for producing a substrate designed to support an object for processing, preferably a substrate for a semiconductor element such as a wafer, the substrate being formed using carbon, giving it a porosity level that forms gas outlet or passage openings, characterized by the following process steps:

- production of a framework made of carbon and/or SiC fibers and
- stabilization of the framework with at least one pyrocarbon and/or silicon carbide layer that forms a matrix,

a framework stabilized in this manner, or a segment of the framework, being used as the substrate.

10. A method according to claim 9,

characterized in that the fibers are stabilized by means of vapor infiltration (CVI) and/or fluid impregnation.

11. A method according to claim 9 or 10,
characterized in
that stabilized felt or fleece or stabilized non-woven material layers are used as the
framework.

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12. A method according to at least one of claims 9 through 11,
characterized in
that the fibers are stabilized exclusively with carbon or exclusively with silicon carbide.

10 13. A method according to at least one of claims 9 through 12,
characterized in
that the fibers are stabilized with a series of one or more coatings comprised of carbon
and/or silicon carbide.

15 14. A method according to at least one of claims 9 through 13,
characterized in that the fibers are stabilized with a graduated system of coatings
that transitions from carbon to silicon carbide.

20 15. A method according to at least one of claims 9 through 14,
characterized in
that the framework is stabilized in such a way that a silicon carbide coating is formed as
the outer layer.

25 16. A method according to at least one of claims 9 through 15,
characterized in
that the density, thermal conductivity and/or porosity of the substrate can be adjusted by
varying the composition of the framework and/or the duration of the vapor infiltration or
fluid impregnation.

30 17. A method according to at least claim 9,
characterized in

that the substrate is adjusted to a porosity level p of $5\% \leq p \leq 95\%$, especially $10\% \leq p \leq 95\%$.

18. A method according to at least claim 9,

characterized in

that the substrate is adjusted to a density ρ of $0.1 \text{ g/cm}^3 \leq \rho \leq 3.0 \text{ g/cm}^3$.

19. A method according to at least one of claims 9 through 17,

characterized by the following process steps:

- application of one or more pyrocarbon coatings to the framework made of carbon and/or SiC fibers,
- cutting of the substrate from the coated framework,
- high-temperature cleaning of the cut-out substrate and
- application of one or more coatings made of silicon carbide to the framework coated with pyrocarbon.